AN OUTLINE OF THE ANTARCTIC MINKE WHALE ASSESSMENT CRUISE (IWC/IDCR) IN 1978/79 TO 1980/81

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Abstract: Since the 1978/79 Antarctic whaling season, extensive and systematic whale sightings and marking cruises on the Antarctic minke whales have been carried out under the International Whaling Commission/International Decade of Cetacean Research (IWC/IDCR) programme.

The programme was carried out in the Southern Hemisphere Whaling Areas (for baleen whales) IV (70°–130°E), III (0°–70°E) and V (130°E–170°W) during the Antarctic summer season in 1978/79, 1979/80 and 1980/81, respectively. The total numbers of minke whales sighted were 5322, 4357 and 5213, and 728, 703 and 474 whales were marked with .410 "Discovery" whale marks in the 1978/79 (Area IV), 1979/80 (Area III) and 1980/81 (Area V) seasons, respectively.

The systematic data of whale sightings and markings obtained from the IDCR cruises contributed not only to stock asseessment but also to development of methodology of estimation technique of whale population. At the 33rd IWC/ Scientific Committee (SC) annual meeting held at Cambridge in June 1981, the exploitable stock size of minke whales was estimated from the data obtained by the IDCR cruises to be 71644, 57951 and 79847 whales by whale sighting based upon the line transect theory, and 71644, 57951 and 79847 whales by the mark-recapture method in Areas III, IV and V, respectively.

For the whole Antarctic, approximately 330000 minke whales of exploitable stock size was estimated as the weighted average by means of whale sightings, marking and a simulation model.

1. Introduction

The Antarctic minke whale, *Balaenoptera acutorostrata*, is the smallest species of balaenopterid whales. Because of its importance as the only object species for the pelagic whaling in the Antarctic, much attentions have been given to the stock of this whale in view of the stock management.

Although a full-scale exploitation of the minke whale in the Antarctic did not begin until the 1971/72 whaling season, several preliminary expeditions had been carried out before that. These expeditions provided basic biological informations for this species (OHSUMI *et al.*, 1970). Since the beginning of the full-scale operation the biological materials have been collected from the catches in each season, and several authors (OHSUMI and MASAKI, 1975; MASAKI, 1979; KATO, 1982) have reported biological parameters related to stock assessments.

On the other hand, in spite of the accumulated biological information estimates of stock size have been little reliable. As commented by BEST and OHSUMI (1980), the difficulties in reliable stock assessment of this species are accounted for by the

simulation model adopted by the International Whaling Commission (IWC)/Scientific Committee (SC), and the "BALEEN" computer programme, originally proposed by KIRKWOOD and ALLEN (1979), has led to the necessity of a more direct, properly organized and scientific census, based upon the whale sightings and marking techniques independent of whaling operations.

Thus, the IWC/SC agreeded to carry out the systematic sighting and marking cruise under the IWC/International Decade of Cetacean Research (IDCR) programme, and at the Committee's annual meeting at Cambridge in June 1978 Drs. P. B. BEST of South Africa and S. OHSUMI of Japan were appointed as the project leaders in this programme.

The first cruise was made in Area IV* (70°–130°E) during the Antarctic summer season in 1978/79, and the results of this cruise contributed much to the stock assessment of the minke whale. The success of this cruise encouraged the IWC to continue the programme, and a similar cruise was made in Area III (0°–70°E) during the summer season of 1979/80 season. Moreover, a special meeting of IWC/SC, Workshop on Sightings Technique and Assessment, was held at Seattle, USA in September 1980, and some recommendations on experiments related to the theory of whale sightings were made for the next IDCR cruise. In the 1980/81 season, the IDCR cruise was carried out in Area V (130°E–170°W) with the above experiments. Several authors (BEST and BUTTERWORTH, 1980; BEST and OHSUMI, 1980; HORWOOD, 1981; HORWOOD *et al.*, 1981; BEST, 1981) reported on these cruises and made some population estimates with the data collected.

As I was able to participate in three IDCR cruises from the 1978/79 to 1980/81 season, I wish to outline, in this paper, the cruises and briefly comment on population assessment.

2. Outline of the Cruises

All the three cruises were carried out in the Antarctic waters between approximately 60°S in latitude and the pack ice edge in the summer season from middle of December to middle of February. A total of 22 researchers from the seven member countries of the IWC participated in the IDCR cruises during the 1978/79 and 1980/81 seasons.

For this programme, the Japanese and Soviet governments provided some scouting vessels of whaling catcher style (Fig. 1) and the crew experienced in whaling operations. Two vessels from Japan were available in the 1978/79 and 1979/80 seasons, whereas in the 1980/81 season three vessels (two from Japan and one from USSR) were used. As a rule, one vessel was engaged in whale sightings and marking in the waters along the pack ice edge line (ice edge zone), while the other searched in northern off shore waters with a grid pattern consisting of legs 3° in latitude and 5° in longitude. In the 1980/81 season, however, the Soviet vessel was engaged mainly in the whale marking and the Japanese ones in the whale sightings in the ice

* The whaling ground for the baleen whale in the Southern Hemisphere is divided into six management areas as follows: Area I (60°–120°W), Area II (60°W–0°), Area III (0°–70°E), Area IV (70°–130E), Area V (130°E–170°W) and Area VI (170°–120°W).

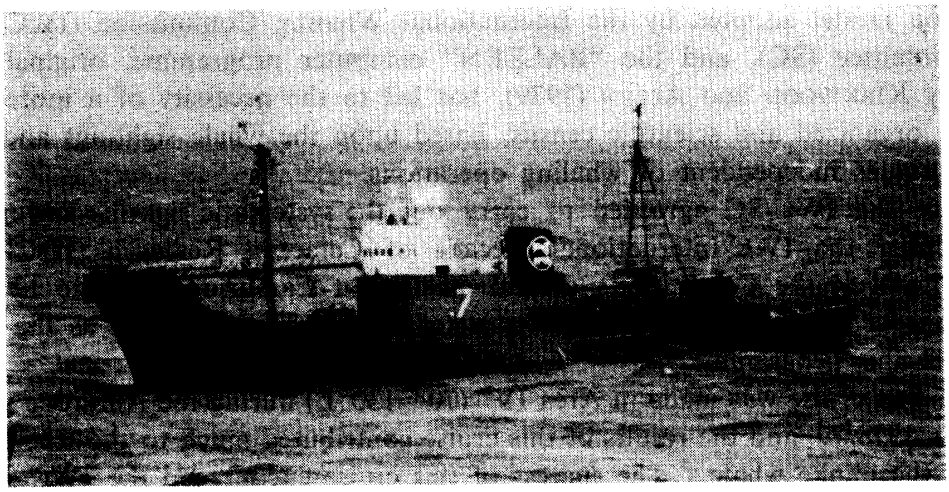

Fig. 1. The scouting vessel used in the IWC/IDCR cruises, photograph showing KYO MARU No. 27 (730 GT) joined in the 1979/80 and 1980/81.

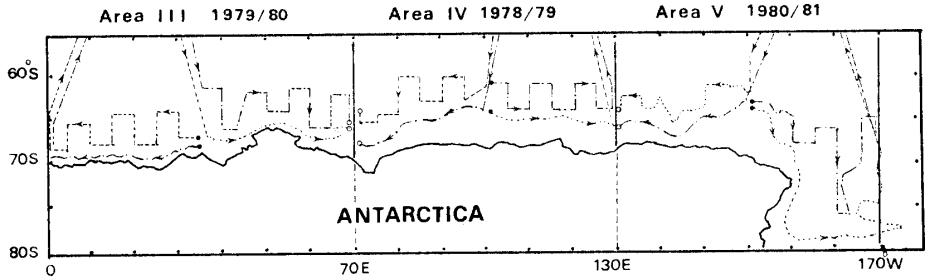

Fig. 2. The tracks of the scouting vessels of the IWC/IDCR minke whale assessment cruises in the 1978/79, 1979/80 and 1980/81 seasons. Open and closed circles show the ending points in the first half area and the resuming points in second half areas for searching, respectively. The symbols of the cruise tracks are: -·-·-, R. V. TOSHI MARU No. 18 in the 1978/79 and R. V. KYO MARU No. 27 in the 1979/80 and 1980/81, ·····, TOSHI MARU No. 16 in the 1978/79 and TOSHI MARU No. 11 in the 1979/80 and 1989/81. The cruise track of R. V. VDUMCHIVYI No. 34 is not shown, but it was almost the same tracks as that of Japanese vessels in the ice edge zone in 1980/81.

edge zone.

Searchings were carried out at a speed of 12 knot from 0400 to 2000 every day, and the vessels drifted usually during the nighttime.

Each Area was divided into western and eastern halves for the convenience of refuelling, mid-cruise meeting and mark-recapture experiments in each season. It was agreeded that the Japanese and Soviet whaling fleets co-operate in the IDCR cruises by the regulations of whaling operation in researched Areas.

The cruise tracks of the total seven vessels in the three seasons are shown in Fig. 2.

2.1. 1978/79 season (Area IV)

Two whaling catcher boats, TOSHI MARU No. 16 (R/V T16, 758 gross tonnage) and TOSHI MARU No. 18 (R/V T18, 758 GT), were provided by Japan as scouting vessels for this season, and six researchers from four countries joined the cruise

under the leadership of Dr. P. B. BEST of South Africa.

The vessels left Fremantle, Australia on 22 December, and reached the starting point of searching in the Antarctic on 29 December 1978. The searchings were carried out westward from 100°E to 70°E, and were completed on 14 January 1979 in the western half. R/V T16 searched in the ice edge zone and R/V T18 in the offshore waters between 58°S and 65°S with the above-mentioned grid pattern. After the searching in the western half was completed, the vessels move to meet Japanese factory ship, NISSHIN MARU No. 3 (24000 GT) which operated in Area III (approximately 66°E, 66°S) for refuelling, mid-cruise meeting and the other purposes. After refuelling, the vessels switched their assinged waters and returned to 100°E to resume the searching in the eastern half, from 100°E on 21 January to 130°E on 7 February 1979, and returned to Fremantle on 14 February 1979. A total of 37 days was spent for the research in this season.

2.2. 1979/80 season (Area III)

The cruise in this season was carried out in the almost same manner as the previous season. Two scouting boats, KYO MARU No. 27 (R/V K27, 730 GT) and TOSHI MARU No. 11 (R/V T11, 740 GT) were used, and six researchers from five countries joined in this cruise (cruise leader, Mr. J. W. HORWOOD, UK).

The vessels left Cape Town of South Africa on 20 December 1979, started searching on 27 December at 35°E and move eastward to 70°E until 16 January 1980 in the eastern half. R/V K27 searched in the ice edge zone and R/V T11 in the offshore waters. Refuelling was made from NISSHIN MARU No. 3 which operated in Area IV (approximately 89°E, 64°S). Afterwards, the vessels went back to 35°E to begin searching in the western half switching their assignments with each other. The searchings in this half were carried out westward from 35°E at 25 January to 0° at 13 February. The vessels returned to Cape Town on 22 February, after total of 41 searching days.

2.3. 1980/81 season (Area V)

In this season, three vessels were provided, R/V K27 and T11 from Japan and VDUMCHIVYI 34 (R/V V34, 718 GT) from USSR. It was decided that R/V V34 should be engaged principally in whale marking in the ice edge zone of the eastern and western halves, whereas two Japanese vessels would switch the assigned waters just like the previous cruises. In the ice edge zone, however, Japanese vessels engaged principally in whale sightings (R/VK 27 in the western and R/V T11 in the eastern half).

Ten researchers from five countries joined and the cruise led by Dr. P. B. BEST of South Africa.

All the three vessels left Wellington, New Zealand on 17 December 1980, and started the searching in the western half of Area V on 22 December at 160°E moving westward to 130°E until 8 January 1981. All the three were refuelled from NISSHIN MARU No. 3 operating in Area IV (approximately 118°E, 65°S). Then, the vessels returned to 160°E on 16 January, to resumme westward searchings in the western half (R/V V34 and T11 reached the bottom of the Ross Sea near 80°S).

The vessels completed their researches on 7 January and returned to Wellington on 12 February 1981, after spending 40 days for searching in this season.

3. Whale Sightings

3.1. Method

During searchings the vessels normally cruised at a speed of 12 knots for whale sightings, and continuous observation was carried out from 0400 to 2000 hours by one watchman (0400–0600 and 1800–2000 for Japanese vessels) or two watchmen (0600–1800 for Japanese vessels) in the top barrel of the foremast. In addition, always one or two persons were engaged in observation on the upper bridge, but most of the findings of whales were made from the top barrel. All observers used binoculars (7×50) for scanning the sea between the cruise course and 90° of either side of the vessels.

When a whale school was found by the vessels, the following data were collected: distance from the vessel to the school (this is regarded as an estimated distance), an angle between the cruise course and the school, the place of sightings and the other information. After, collections of the initial sightings data, the vessels at full speed (about 15 knots) approarched the estimated point of finding of the school. The time between finding of the school and the arrival at the point was recorded by a stopwatch in order to estimate the distance of the whale school from the vessel with the time and speed (this is called a calculated distance). At the same time, the angle between the original and succeeding courses was recorded to estimate a more accurate sighting angle. When the sighting angle was less than 15°, the original course was kept until the sighting angle became more than 15° (time and speed were recorded), and then the course was changed to approach the whale school.

The distances and angles were carefully recorded as these are the most important parameters in abundance estimate by the sighting technique.

When the vessel approarched the school, reaction of whales against the vessel was observed, and species, school size and body length composition were estimated. Associated living things, if found, were also recorded.

The whale sightings data format used in the recent cruise is shown in Fig. 3.

In the highly dense areas of the minke whale, however, different schools were often found when the vessel was approaching, chasing or marking the whales. Such sightings are classified as "secondary sighting" distinguished from "primary shighting" which made while the vessel is engaged in searching. "Unconfirmed sighting" of the whale which was not approarched by the vessels or seen only briefly should not be used for estimating abundance.

The searching effort is also important in whale sightings. It was recorded by the chronological account of the vessel's activities, so that the searching distance was calculated from the duration and the speed of searching.

Weather and sea conditions, such as wind direction and speed, surface temperature, visibility, ice coverage and weather, were recorded intervals of one hour. In addition, in the recent cruise, sightability (relative degree of water surface and background condition for whale sightings) and the names of the observers in the top bar-

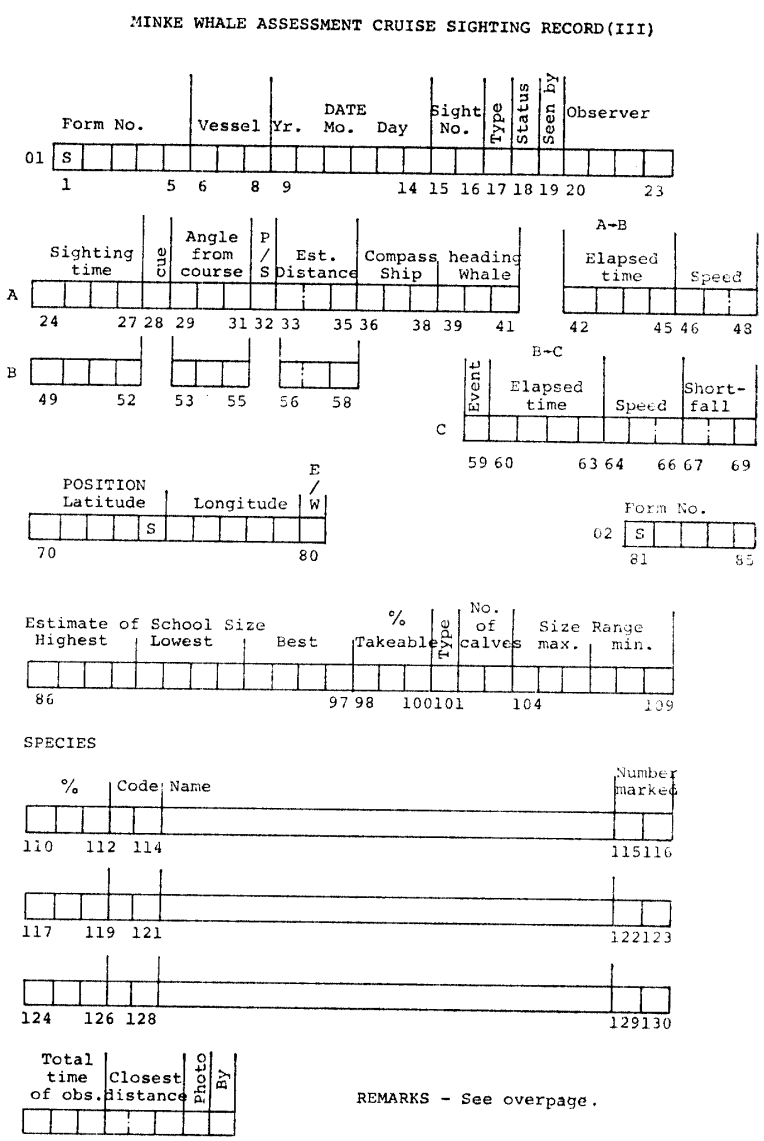

Fig. 3. Data form for whale sightings in the IWC/IDCR minke whale assessment cruise in the 1980/81.

rel so as to examine individual ability for sighting were recorded in the same intervals.

3.2. Result

The numbers of schools and whales found in the cruises during three seasons from 1978/79 to 1980/81 are summarized in Table 1, based upon BEST and BUUTTERWORTH (1980), HORWOOD (1981) and BEST (1981), but the data of sightings by R/V V34 are excluded from table.

In the three seasons a total of 11 cetacean species was recorded. However, it was slightly difficult to identify species of Ziphiid whales due to their elusive behaviour. With regarding to the baleen whales, sightings of the minke whale were remarkably numerous compared with the other species, and numbers sighted were 5322 in 1087, 4357 in 1046 and 5213 whales in 1716 schools in the 1978/79 (Area IV),

Table 1. Confirmed number of whales sighted in the IWC/IDCR minke whale assessment cruises from 1978/79 to 1980/81 seasons.

Species	Area III 1979/80	Area IV 1978/79	Area V* 1980/81
	Number of whales/Number of schools		
Minke	4357/1046	5322/1087	5213/1716
Fin	47/28	4/2	41/13
Blue	21/12	3/2	7/4
Sei	8/3	3/2	3/2
Humpback	66/35	49/27	17/10
Sperm	47/28	136/47	118/95
Ziphiid	374/163	351/132	77/37
Killer	334/34	774/52	1691/41
Pilot	85/2	778/7	310/7
Hourglass dolphin	81/9	59/5	256/7
Dusky dolphin	5/2	—	31/5
Right whale dolphin	60/1	—	(36/2)**
Stenella spp.	2070/5	—	—

* sighting data by V34 are excluded in counting the total species in Area V (1980/81 season).
** sighted by V34.

1979/80 (Area III) and 1980/81 (Area V) seasons, respectively, and the concentrated areas of the minke whale were observed in the ice edge zone.

3.3. Assessment of abundance

Estimation of animal abundance by means of whale sightings is based upon the line transect theory (GATES *et al.*, 1968; SEBER, 1973) in the IWC/SC. The basic formula of the line transect theory is:

$$N = nA/2L\lambda ,$$

where, N=size of abundance in area A, n=number of whales sighted, A=surveyed area, L=searching distance and λ=coefficient of probability of animals sighted, given from the function $g(y)=e^{-\lambda y}$ (y, right angle distance).

As mentioned previously, there has been much discussion about the sighting theory, consequently, a special meeting to consider the matter was held in Seattle, USA in September 1980, and several suggestions on the theoretical points in sighting survey were made at the meeting. The following experiments were carried out to get data to improve the sighting theory in 1980/81 season (BEST, 1981):

(a) Variable speed experiment, to examine the assumption that all animals on the trackline were seen.

(b) Parallel ship experiment, to investigate whale reaction to vessels.

(c) Dive time, to examine the frequency and duration of visual cue provided by schools of different size and under different environmental conditions.

(d) Observer behaviour, to examine the patterns of searching used.

Details of the results of these examinations will be reported in the near future.

BEST and BUTTERWORTH (1980) estimated the exploitable stock size of the minke whales, rather than the total population size, to be 78000 animals from the sighting data in Area IV in the 1978/79 season based upon the line transect and truncated models, and HORWOOD (1981) also estimated the exploitable stock size to be 71250 animals in Area III by basically the same methods as that of BEST and BUTTERWORTH (1980) using the data obtained from the IDCR cruise in 1979/80.

Moreover, the systematic data obtained from the IDCR cruise led to the discussion on the assessment of animal abundance by means of sightings, at the IWC/SC meeting held in Cambridge in June 1981. The sighting sub-group modified and agreed on the following assumption (Anonymous, 1982):

$$P = t\ e\ h\ s\ N',$$

where, P=exploitable stock size, t=percentages of takable animals in the population, e=correction factor acounting for a change from the untruncated negative exponential distribution, $h = 1/g(0)$ the reciprocal of the probability of sighting an animal on the trackline, s=mean school size, N'=estimated number of schools in an area calculated using the contouring method and assuming an untruncated negative exponential distribution for the right angle distance.

Utilizing the above assumption, exploitable stock sizes of the minke whale were reanalyzed and calculated to be 71644, 57951 and 79847 whales in Areas III, IV and V, respectively, from the sighting data of the IDCR cruises (Anonymous, 1982).

4. Whale Marking

4.1. Method

Although the whale marking has a long history for several species and areas, such an extensive and systematic marking cruise as this IDCR programme has not been carried out previously.

All markings on the minke whale were carried out with "Discovery" whale marks of .410 size, rather than 12-bore marks which were used for large whales (Fig. 4), and in the 1980/81 season small number of streamer marks of .410 size were used in order to clarify the judgement of the marking result, but it was still difficult to use them practically due to mechanical troubles of mark tube.

Markings were conducted always after sighting survey of the school was completed. Marks were fired from the gunner's deck of the vessels. One marksman with one researcher who judged the marking result was the normal case, but in case of a relatively large school of whales, two marksmen were used, if tow judges were available. Marking results were to be judged only by the researchers according to the following categories: Hit, Possible hit, Hit but protruding, Ricochet, Miss, No verdict and Miss fire. When marking was carried out, date, mark number (serial), firing distance, estimated body length, struck position on the body, identified number of individuals in the school, result, position (first sighted position rather than marked) were recorded in each firing.

Duble tagging was avoided as a rule, and no marking was tried for smaller animals (less than 20 ft in body length). Since the 1979/80 season, all marks have been sprayed with a general sterilizing agent, Ghlorexidine Glucinate (Hibitan), before

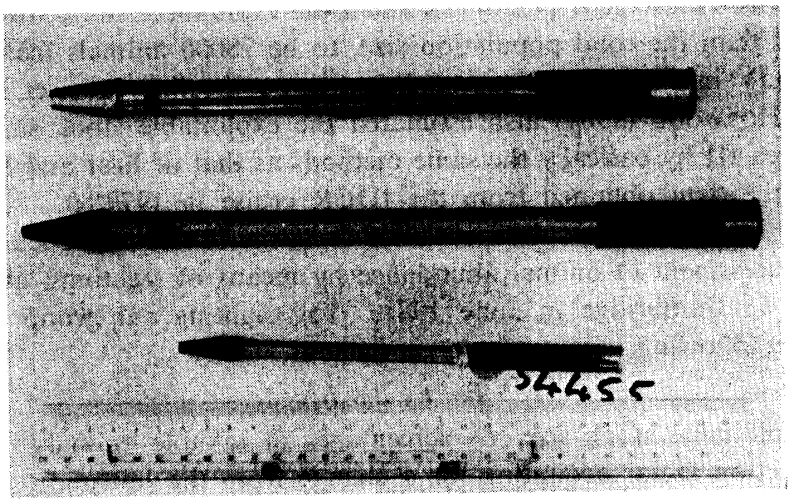

Fig. 4. "Discovery" type whale marks; upper and middle are 12-bore marks for large whales, and bottom is .410 mark for the minke whale.

marking to avoid the damage of tissue around the marks in the whale body (HORWOOD, 1981). Moreover, marks should be fired to hit the safe part of the body, *e.g.* anterior and near the dorsal fin, at suitable firing distances (10–30 m). These were determined by the result of the firing experiments of .410 marks by use of a whale carcase on the deck of the Japanese factory ship in the 1979/80 season (KATO, 1981).

Table 2. Summary of whale markings in the IWC/IDCR minke whale assessment cruises from 1978/79 to 1980/81 seasons.

Area / Season	Area III 1979/80		Area IV 1978/79		Area V 1980/81	
Result	.410	12-bore	.410	12-bore	.410	12-bore
Hit	710	5	786	16	490	12
Hit, protruding	37		43	9	24	7
Possible hit	332		262	3	158	1
Ricochet	44		25	—	80	—
Miss	245		314	4	429	1
No verdict	35		26	3	24	—
Miss fire	4		1	3	7	—
Other	1		—	—	2	—
Total	1408	5	1457	38	1214	21
Minke whales marked	703	—	728	—	474	—
(double marked)	7	—	58	—	13	—
(other invalid)	4	—	—	—	3	—
Sperm whales marked	—	5	—	8	—	12
(double marked)	—	—	—	1	—	—
Humpback whales marked	—	—	—	7	—	—
(double marked)	—	—	—	—	—	—

4.2. Result

Table 2 is a summary of whale markings during three seasons from 1978/79 to 1980/81. The total of 728, 703 and 474 minke whales were marked with .410 marks in the 1978/79 (Area IV), 1979/80 (Area III) and 1980/81 (Area V), respectively.

Although small numbers of humpback whales, *Megaptera novaeangliae*, were marked in the 1978/79 season, the target species for marking were primarily minke whales with .410 and secondarily sperm whales, *Physeter macrocephalus*, with 12-bore marks since the 1979/80 season, and no marking was tried for other species.

In all the three seasons, about one week after the end of IDCR cruises the Japanese whaling fleet entered into the western half or eastern half of one Area to operate whaling to get reliable data of mark recovery.

A total of 22 marks fired in the IDCR cruises have been recovered from the catches of minke whales by Japanese and Soviet fleets until the 1980/81 season, as shown in Fig. 5. Regarding the movement of marked whales, most of marks were recovered in the same Areas as that were marked. Although some marks were recovered in the different Areas that were marked among Areas III and IV, these markes fired in the waters near the boundary of two Areas.

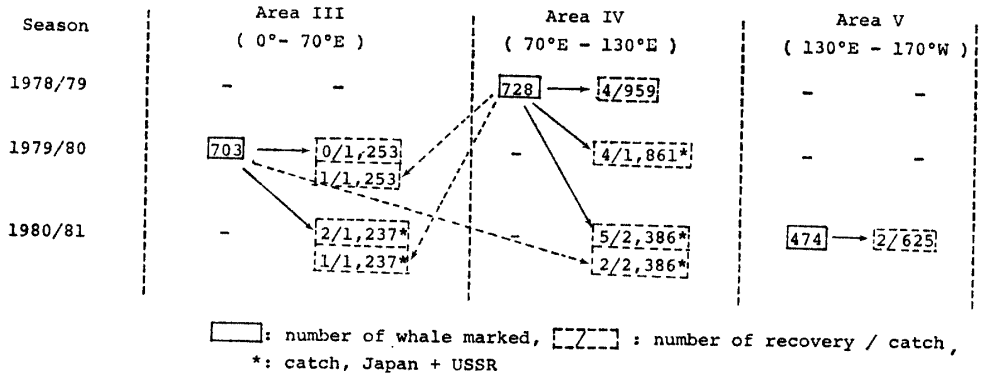

Fig. 5. Summary of the whale markings in the IWC/IDCR minke whale assessment cruises and recoveries in the catches during 1978/79 and 1980/81 Antarctic whaling seasons.

4.3. Population assessment

The mark-recapture technique has been applied to population estimate of whales. According to CHAPMAN (1951) and SEBER (1973), the population size of animals can be estimated as follows:

$$N=\frac{(n_1+1)(n_2+1)}{(m_2+1)}-1,$$

$$V=\frac{(n_1+1)(n_2+1)(n_1-m_2)(n_2-m_2)}{(m_2+1)^2(m_2+2)},$$

where, N=estimated population size, V=variance in estimate, n_1=number of animals marked, n_2=number of animals recaptured (catch) and m_2=number of marked animals in n_2.

It is necessary, however, to estimate mark recovery efficiency in the process of whale

carcase on the factory ship. Therefore, m_2 should be corrected as follows:

$$m_2' = m_2/r ,$$

where, m_2' = true number of marked animals in n_2, r = mark recovery efficiency. In order to obtain the reliable value of the r, several experiments were carried out on board the Japanese factory ship in 1978/79 season (BEST and BUTTERWORTH, 1980). Moreover, experiments in the same manner were continued during the 1979/80 and 1980/81 seasons (KATO and MIYASHITA, 1982). Both authors reported that the efficiency in mark recovery by the Japanese fleet was 1.0. Such a high rate would be due to the careful treatment of the whale carcase and to the use of a metal detector to check whale marks on all frozen goods. It was reported that the same experiments related to the estimation of values of r were carried out for the Soviet fleet, but details have not yet been reported. In addition, tagging mortality should be taken into account in population assessment with the mark-recapture method. This value was assumed to be 5% of marked animals tentatively for the minke whale (BEST and BUTTERWORTH, 1980).

BEST and BUTTERWORTH (1980) estimated exploitable stock size in Area IV to be 91000±38000 (or 106000±44000) from the mark-recapture data in the 1978/79; four marks out of 728 marked whales were recovered in the catch of 959 minke whales in Area IV.

No mark out of 704 marked whales was recovered from 1253 minke whales caught by the Japanese fleet in Area III in the 1979/80. HORWOOD (1981) tried to estimate the exploitable stock size to be 127000 whales as a tentative result from the mathematical assumption of the relation between the number of marked whales and the exploitable stock size and the probability of capturing no marked whale.

Two marks out of 474 marked whales were recovered from the Japanese catch of 625 minke whales in Area V in the 1980/81. From the data of IDCR cruise and recoveries the population estimate was made at the special meeting of the IWC/SC in 1981, and exploitable stock size was estimated to be 94109±93774 (2SD) whales (Anonymous, 1982).

On the other hand, several marks which were fired in the previous seasons have been recovered from the catches of Japanese and Soviet fleets in Areas III and IV in the 1979/80 and 1980/81 seasons (these are "series of mark-recapture data"). According to TILLMAN (1982) and MIYASHITA (1982a), the population size can be estimated with survival marked whales which estimated by the following:

$$M_i = M_i' + (M_{i-1} - R_{i-1})\,e^{-M} ,$$

where, M_i = number of survival marked whales in season i, M_i' = number of marked whales just before the season i, R = recovered whales and M = natural mortality rate. TILLMAN (1982) examined the series of mark-recapture data which were reported by MIYASHITA (1982a), and estimated exploitable stock size of 257790 and 137417 minke whales in Areas III and IV, respectively.

5. Discussion

The Antarctic minke whale assessment cruise under the IWC/IDCR programme

have contributed not only to stock assessment of this species, but also to the development of methodology of population assessment. Some theoretical points which have been discussed on whale sightings will become more clear by the several experiments is planned to carry out in the future IDCR cruises.

However, informations to be recorded in each whale school has been gradually required more data with the developments of sighting theory. In this connection, one of the most realistic problems is seemed to be the inconsistency of whale sightings with whale marking in high density areas of whales. Therefore, separation of sightings and marking vessels as conducted in the 1980/81 season would be efficient in the ice edge zone to solve such a problem.

Population estimate by the mark-recapture method shows much variance in the results. These may be due to too small numbers of marked whales compared with their stock size. On the other hand, in the sightings apart from the theoretical points, the waters north of 60°S and within the pack ice area are disregarded in the population assessment. The results of whale sightings, therefore, represent only a part of the total populations in the Southern Hemisphere, and in this connection many minke whales were observed in the waters inside the pack ice area (NAITO, 1982).

At the special meeting of the IWC/SC in June 1981, it was agreed that the stock assessment of the Antarctic minke whales should be made by independent estimates by three techniques, whale sightings, marking and simulation models ("BALEEN" was used only in Areas IV, V and VI), using the weighting averages by inverse of their variances. Thus, the estimates of 85790, 44767 and 51075 whales were obtained for the exploitable stock size in Areas III, IV and V, respectively (Anonymous, 1982). These estimates would be conservative due to too low estimates in the simulation model.

On the other hand, regarding to the Areas which have not been covered by the IDCR cruise, Fisheries Agency of the Japanese government, has conducted whales sightings and marking in the Antarctic under the International Marking Schema in Areas I and IV (OHSUMI, 1981; MIYASHITA, 1982b). The data obtained from this programme were also used in the stock assessment with the simulation models, and exploitable stock size of the minke whales were estimated to be 28628 and 54142 whales in Areas I and IV, respectively (Anonymous, 1982).

Whereas no estimates were agreed in Area II due to the lack of systematic data. Therefore, the next IDCR cruise is planned in Area II during the 1981/82 season. At the 33rd IWC meeting in July 1981, the Japanese and the Soviet governments agreed to provide two and one scouting boats, respectively, as the case with the previous cruise. The planning meeting for the next IDCR cruise in Area II has been held in Tokyo on 8–11 September 1981 in order to discuss the details of the cruise. This cruise will collect valuable informations like the previous cruises.

The total exploitable stock size for the whole Antarctic at the present can be estimated to be at least approximately 330000 whales (including the tentative estimate of 56358 in Area II, Anonymous, 1982). However, more reliable estimation will be obtained by continuing the IWC/IDCR programme on the Antarctic minke whales.

Finally, it is notable that systematic research such as the IDCR cruises in the Antarctic will bring much information related to number, distribution and biological aspects of whales not only for exploited but also for protected whale species.

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